FY 1984 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

1. (U) RESOURCES (PROJECT LISTING): ($ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	42,939	62,573	71,066	77,559	Continuing	Not Applicable
2617	Free-flyer Spacecraft Missions	20,200	27,673	34,060	35,449	Continuing	Not Applicable
2620	Shuttle Sortie Missions	22,739	34,900	37,006	42,110	Continuing	Not Applicable

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Space Test Program (STP) advances DOD technology by providing spaceflight missions for experiments that demonstrate new space system technologies, concepts and designs and that determine space environmental effects on DOD space systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technology designs. The STP is to be the pathfinder for exploiting the Shuttle as a manned DOD space laboratory which should expedite the infusion of new technology into space systems through the use of simpler, incrementally-designed, man-aided experiments. The experience gained from this approach will be a key element in fully defining man's military role in space.

3. (U) COMPARISON WITH FY83 DESCRIPTIVE SUMMARY: ($ In Thousands)

RDT&E	42,639	62,573	73,738

The difference of +300K in FY82 was due to the addition of funds to include a National Security task in NASA's Space Station Needs, Attributes and Architectural Options Studies. This money was transferred to NASA for disbursement to the eight contractors participating in these studies. The FY 1984 difference is due to inflation adjustments.

PROCUREMENT Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Expendable launch vehicles and their corresponding launch support are provided by Space Boosters, Program Element PE 35119F. Space Shuttle launch support and Inertial Upper Stage (IUS) systems are provided by Space Launch Support, PE 35171F. Host satellites for STP payloads include the Defense Meteorological Satellite (DMSP), PE 35160F; NASA Long Duration Exposure Facility (LDEF) and classified programs. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency, PE 62301E, PE 62711E, and PE 62701E; National Aeronautics and Space Adminstration; Defense Research Sciences PE 61120F; Geophysics, PE 62101F; Materials, PE 62102F; Aerospace Propulsion, PE 62203F; Advanced Weapons, PE 62601F; Missile Surveillance Technology, PE 63424F; Space Surveillance Technology, PE 62428F; Satellite Systems Survivability, PE 63438F; Space Vehicle Subsystems, PE 63401F; Systems Survivability, PE 64711F; and Advanced Space Communications, PE 63431F.

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6. (U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the Space Test Program (STP). Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Current payload integration and/or spacecraft contractors are Rockwell International, Seal Beach, CA, and Lockheed Missiles and Space Company, Sunnyvale, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1984: Not Applicable

8. (U) PROJECTS OVER $10 MILLION IN FY 1984:

(U) Project: 2617 Free-flyer Spacecraft Missions

A. (U) Project Description: This Space Test Program (STP) project supports advances in DOD space technology by providing for the spaceflight of experiments on STP developed free-flyer spacecraft for the demonstration of new system technologies, concepts and designs and for determining space environmental effects on military space systems. In addition, this project supports the spaceflight of small secondary payloads on free-flyer host spacecraft. The project provides spacecraft procurements, payload integration, launch support, and orbital support. Space Shuttle launch support tasks are provided by PE 35171F, Space Launch Support. This project currently supports the development of STP spacecraft to support the Defense Advanced Research Projects Agency (DARPA) Teal Ruby mission, the Defense Nuclear Agency HILAT mission and the integration of numerous secondary experiment missions on host spacecraft.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1982 Accomplishments: In FY 1982 the Space Test Program finalized the development and acquisition of hardware to accomplish the STP/Defense Nuclear Agency P82-1 HILAT mission. The STP played a major role in the no-cost acquisition of a surplus Navy Transit satellite for use as spacecraft bus to support the DNA experiments on orbit. To accomplish the launch of the P83-1 HILAT satellite, STP obtained a surplus Scout launch vehicle from NASA -- also at no cost. Use of these surplus items is resulting in a savings of approximately $13M and an earlier launch of these important payloads which will investigate the effect of nuclear and naturally disturbed ionosphere on communications systems. In May 1982, STP secondary mission S81-1 was successfully flown on a classified host satellite. This mission flew two Office of Naval Research experiments that are investigating new techniques to provide jam-resistant VLF/ELF communications. Significant deliveries of major subsystems for the STP P80-1/Teal Ruby spacecraft were completed. This spacecraft will support the DARPA Teal Ruby sensor and two secondary experiments. Subsystem and system level technical and testing problems have delayed the Teal Ruby/P80-1 launch on the Shuttle from [ ]

(2) (U) FY 1983 Program: Efforts will continue on the delivery and testing of subsystems to support P80-1 spacecraft development and Teal Ruby sensor integration. Payload integration and launch services support will be provided for the STP/Defense Nuclear Agency P83-1 HILAT mission, and on-orbit support will be provided after its launch from Vandenberg Air Force Base in June 83. STP will provide support for the integration of a complement of four secondary payloads (S80-1) in NASA's Long Duration Exposure Facility (LDEF) satellite. These experiments will allow determination

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of space environmental effects on spacecraft materials, and active/passive radiation hardened fiber optics components. Integration of secondary payload S81-2 on a host Defense Meteorological Satellite Program (DMSP) satellite will be completed to support the scheduled DMSP launch date. This experiment will collect data to improve our ability to predict auroral conditions and their effect on a communication systems. Efforts will continue to define future missions to support the spaceflight of other approved DOD experiments.

(3) FY 1984 Planned Program and Basis for FY 1984 Request: The major effort in this project in FY 1984 will be the continued delivery of P80-1/Teal Ruby spacecraft subsystems and components for spacecraft integration, subsystem and system level testing, and resolution of problems arising from the testing. All of these efforts are geared to support the new P80-1/Teal Ruby mission launch date from the Space Shuttle in [ ] The Teal Ruby mission, known by its primary Defense Advance Research Projects Agency (DARPA) payload of the same name, also carries Army and National Aeronautics and Space Administration (NASA) secondary payloads. The DARPA experiment will demonstrate new [ ] infrared technologies and collect data needed for the design of future space-based aircraft and missile detection systems [ ] The P80-1 spacecraft will also support at least two secondary payloads -- the testing of a NASA sponsored ion thruster experiment and its capabilities for long-term, satellite station-keeping and an Army ultraviolet spectrometer experiment studying the space ultraviolet (UV) spectrum. Integration and testing will be completed for the complement of experiments S80-1 to be launched from the Kennedy Space Center on the NASA LDEF reusable, free-flying satellite. The exact launch date for this satellite from the Space Shuttle and its retrieval date (approximately 12 months later) are dependent on NASA Shuttle manifesting. The projected launch date is 2Q FY84. Upon launch, STP will provide on-orbit support to the experimenters. STP will continue to provide on-orbit support to the DNA HILAT mission and the DMSP host mission S81-2. Efforts will continue to define future missions to support the spaceflight of other approved DOD experiments.

The cost estimating techniques used by the STP include the use of existing AF Space Division cost models, AF Systems Command cost models, independent Aerospace Corporation models, contractor estimates and a large data base of experience from developing previous STP free-flyer spacecraft missions.

C. Major Milestones

		Dates
(1)	Scout launch of DNA HILAT P83-1 spacecraft	June 1983
(2)	Atlas launch of DMSP (F-7) - host satellite for S81-2	[ ]
(3)	Shuttle launch of NASA LDEF - host satellite for S80-1	2Q FY 84
(4)	Shuttle launch of Teal Ruby P80-1 spacecraft	[ ]

9. (U) PROJECTS OVER $10 MILLION IN FY 1984

(U) Project: 2620 Shuttle Sortie Missions

A. (U) Project Description: This Space Test Program (STP) project advances DOD space technology by providing for the spaceflight of experiments on Shuttle sortie missions (payload/experiments remain in Shuttle and are returned) for

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demonstrating new system technologies, concepts and designs and for determining space environmental effects on military space systems. Through sortie missions using the reusable, standard STP Shuttle experiment support equipment STP will accomplish its pathfinder requirement for exploiting the Shuttle as a manned DOD space laboratory. Capability to control payloads in the payload bay from the aft flight deck as well as the capability to actually store and perform payload experiments in the aft flight deck will be developed. The experience gained on these sortie missions will be a key element in defining man's military role in space. The project also supports the flight of secondary experiments in NASA Get-Away Special containers and on other support structures being flown in the Shuttle sortie mode. Project provides for procurement of reusable Shuttle experiment support equipment, integration of payloads on the Shuttle experiment support equipment and the integration of the combination into the Shuttle, mission/payload specialist training on STP hardware, launch support, and on-orbit support. Shuttle launch support is provided by PE 35171F, Space Launch Support This project currently supports the Experiment Support System (ESS)/Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) 1A mission and two Talon Gold space based laser acquisition, tracking and pointing missions.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1982 Accomplishments: [

] Preliminary planning and mission studies to support the integration of the DARPA Talon Gold experiments for Shuttle sortie missions continued.

(2) FY 1983 Program: [ ]of the ESS to support the flight of the CIRRIS IA experiment and three other approved DOD experiments [ ]will begin. This STP mission will seek to conduct the entire mission (control the experiments from the aft flight deck of the Shuttle) utilizing a trained Manned Spaceflight Engineer (MSE) and payload/payload bay interface equipment. The primary experiment CIRRIS IA, will gather data key to the[

] Payload integration of two small payloads (S83-1 and S83-3) with a NASA

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Get-Away-Special (GAS) canister will be completed. STP is funding modification and space qualification of these GAS cans to incorporate an opening lid and a viewing window. Both of these payloads will be flown on sortie missions in FY 1983. STP will continue to work with DARPA to establish a technical baseline for the Shuttle integration of two Talon Gold missions. The purpose of these missions is to demonstrate the feasibility of acquisition, tracking and pointing systems for application to a space-based laser weapon system. STP will continue, within available funding, to acquire standard, reusable Shuttle experiment support equipment to further the exploitation of the Shuttle as a manned DOD laboratory.

(3) FY 1984 Program and Basis for FY 1984 RDT&E Request: [ ] of the ESS to support the flight of CIRRIS IA and three other experiments will continue. Actual integration of the payloads to the ESS structure will begin. Development of the interface hardware between the aft flight deck and the payload bay will continue and integration testing of the Shuttle and payload interfaces will commence. Mission operations and astronaut MSE training plans will be developed to support experiment mission requirements. The ESS/CIRRIS IA mission is scheduled for a [ ] STP will complete the integration of a small payload (S84-1) into a NASA GAS can and provide support for its launch in FY 1984. Based on a jointly developed (STP and DARPA) technical program baseline, STP will begin the efforts necessary to fly the DARPA Talon Gold I and II missions on the Space Shuttle in [ ] respectively. STP will support the development and acquisition of equipment necessary to integrate the DARPA experiments into the Space Shuttle payload bay and equipment necessary to interface with the payloads for the purpose of on-orbit operation. STP will also provide the necessary analytical efforts to support the integration activities. These seven-day sortie missions are key to the development of an acquisition, tracking and pointing system for a space-based laser weapon system. STP will continue the development/acquisition of equipment to support direct manned involvement with experimental payloads located in the Shuttle aft flight deck and in the payload bay. Development of these capabilities will expedite the infusion of new technology into space systems through the use of more simple, less costly, incrementally designed, man-aided experiments. Experiment results and experience in using this approach will be key elements in fully defining man's military role in space.

The cost estimating techniques used by the STP include the use of existing AF Space Division cost models, AF Systems Command cost models, independent Aerospace Corporation models, and contractor estimates. Since no significant data base exists for Shuttle sortie type missions (except ESS/CIRRIS I), STP is developing cost estimating capabilities as they gain experience in integration and operations activities with Shuttle.

C. Major Milestones:

Milestones	Dates
(1) Shuttle sortie mission of GAS payload S83-1	3Q FY 83
(2) Shuttle sortie mission of GAS payload S83-3	4Q FY 83
(3) Shuttle sortie mission of GAS payload S84-1	2Q FY 84
(4) Shuttle sortie mission of ESS/CIRRIS IA (R-12)	[ ]
(5) Shuttle sortie mission of Talon Gold I	
(6) Shuttle sortie mission of Talon Gold II	

P... ...: 63401F Titl Advanced Spacecraft Technology
Bu... ...ion Area: 410 - Space Launch and Orbital Support Bud... Activity: 2 - Advanced Technology Development

6. (U) WORK PERFORMED BY: The Air Force Space Technology Center, Kirtland AFB, NM, manages the program and executes Projects 2181, and 2198. The Air Force Aeropropulsion Laboratory, Wright-Patterson AFB, OH, executes Project 682J. The primary contractors are Hughes Aircraft Co., El Segundo, CA (Project 628J--Solar Cells and Batteries); Sandia National Laboratory, Albuquerque, NM; International Business Machines, Manassas, Va; RCA, Moorestown, NJ; Honeywell Inc., Clearwater, FL; Singer Kearfott, Melbourne, FL (Project 2181--Space Hardened Electronics).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1988 AND/OR FY 1989:

A. (U) Project: 682J, Advanced Space Power Supply Technology: This project develops and demonstrates power system technology for subsystems and components for spacecraft. These technologies will provide increased power output, lifetime and increased nuclear and laser hardness at substantially reduced volume, cost and weight. Development efforts include: Gallium Arsenide (GaAs) solar cells, Nickel-Hydrogen (NiH_2) batteries, high energy density Sodium Sulfur (NaS) rechargeable battery, survivable solar concentrator photovoltaic array panels, and advanced multi-band gap GaAs solar cells. A performance data base is being established by ground testing the batteries in simulated orbits and flight testing solar cells as a space experiment such as on the Combined Release and Radiation Effects Satellite (CRRES) experimental test of GaAs solar panels. Planning for a program to develop a High Energy Density Rechargeable Battery (HEDRB), based on the Department of Energy's research on Sodium-Sulfur batteries, will continue in FY 1987 and FY 1988. The FY 1987 program will continue to design, develop, and demonstrate satellite system technologies to provide necessary increased power generation, storage, and conditioning capabilities. The NiH_2 IPV cell completed qualification testing in FY 1986. Life performance testing (lasting five years) of NiH_2 batteries will begin in FY 1987 and continue through FY 1992. The launch of the CRRES satellite, carrying the GaAs solar cell experiment has been delayed to at least FY 1990. The GaAs solar cell experiment has been delivered in FY 1986 to the CRRES satellite contractor. After the experiment is integrated and checked out, the satellite will be placed in storage. Funds in FY 1988/1989 will fund storage activites. The development of a survivable concentrating photovoltaic solar array will begin in FY 1987.

B. (U) Project: 2181, Advanced Space Computer Technology. This project funds space hardened microelectronics which will increase the survivability and onboard data processing capability of military space systems. Military satellites are key links in the U.S. warfighting capability and must be survivable. These satellites currently require advanced computer electronics, hardened to survive the space environment, will improve space satellite mission performance. Future missions have identified the need for a factor of 10 to 100 improvement in onboard processing capability. The microelectronics package to fly on CRRES was delivered to the CRRES contractor in FY 1986. In FY 1987, this package will be integrated, checked out and prepared for launch. Funds in FY 1988/1989 will support storage activities of the CRRES satellite until its planned launch in FY 1990. The first lot of 64K Random Access Memory (RAM) test chips completed testing in late FY 1986. The results of these tests identified severe design problems. Because these design problems would require additional funds to correct, the 64K RAM development will be integrated into the Generic Very High Speed Integrated Circuit computer development providing the required time and resources to solve design problems. The first lot of 256K Electronically Erasable Programmable Read Only Memory (EEPROM) test chips will be tested early in FY 1987. Following this initial testing, subsequent chip deliveries in FY 1987 and early FY 1988 will undergo qualification testing completing the development program in FY 1988. In FY 1986 the 4MBIT bubble memory chip technology development contract was awarded. However, during the year the 4MBIT development contractor decided not to pursue future bubble memory